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Re: Review Comments
Missouri's Risk-Based Corrective Action
Draft Final Technical Guidance

Dear Mr. Spratlin and Ms. Tapia:

Thank you for your review and comments on the draft Missouri Departmental *Risk-Based Corrective Action (MRBCA) Technical Guidance*. The Department of Natural Resources (department) received an undated list of generic comments from the U.S. Environmental Protection Agency (USEPA), Region VII, in March and received specific comments by email on April 27, 2005. Subsequent correspondence from the USEPA was received on June 23 and July 15, 2005. This response encompasses the specific comments of April 27 and all subsequent correspondence. For both the USEPA and the department, the objective of this program is the protection of human health and the environment, and we appreciate and take very seriously your comments toward achieving that common goal.

The department oversees response and remediation actions at over two thousand contaminated sites in Missouri. With our extensive background in the assessment and remediation of hazardous waste, we are the appropriate agency in the state of Missouri for developing the state's risk-based process. In our capacity as lead agency, the department has also worked with a number of stakeholders through the Risk-Based Remediation Rule Workgroup (Workgroup). The common goal of the Workgroup in discussions and meetings is to provide a framework for remediation decisions that facilitate the constructive use of contaminated sites by protecting human health and the environment in the context of current and future site use.

The Workgroup discussions are based on defensible science to find the balance between protection of human health and the environment from contaminated sites and facilitating the development and re-use of such sites. Of which, the latter:

- reduces development pressure from urban sprawl on "green fields" and Missouri's streams and forests, and
- provides for re-use, development and employment in cities with existing infrastructure, which lessens the economic burdens on families and urban social structure.

Although the latter is not a specific mandate for either of our agencies, we are confident that it would be supported by both agencies.

In order to encourage remediating parties and site owners to enter into any cleanup program, the department believes that it is important to provide an avenue for the cleanup of contaminated sites that is fully protective of human health, welfare and the environment yet not overly burdensome, expensive, and time-consuming. In the past, concerns about cleanup requirements that go beyond the levels necessary to address the risks posed by sites has discouraged the application of sites to our Voluntary Cleanup Program, and therefore hindered the cleanup of those sites.

We have also strived to bring consistency to Missouri's programs and to move the state further toward establishment of one cleanup program, a goal shared and advocated by USEPA at the national level.

Through pilot projects, we are testing the effectiveness of our process and finding it acceptable. We tested the MRBCA process while meeting applicable laws and regulations. The USEPA's project managers have been involved with and provided input into the application of the draft MRBCA process at facilities of mutual interest. The MRBCA process is intended to achieve protection of human health and the environment in a manner that is consistent, cost-effective, streamlined, predictable, reasonably conservative, and conducive to the re-use of blighted properties. Given the very large number of known impacted sites and many yet to be discovered sites as well as the need for governmental efficiency, it is imperative that the department develops a consistent, predictable, and streamlined risk evaluation process.

The departmental MRBCA Technical Guidance is intended to apply to all of the department's cleanup programs, except for Tanks sites, which are covered by the *Missouri Risk-Based Corrective Action (MRBCA) Process for Petroleum Storage Tanks* (first published in February, 2004). Section 1 of the departmental guidance specifically states: "…the MRBCA process does not in any way supercede or change applicable federal statutes and regulations. It does not supercede the requirement that state programs authorized by the USEPA (for example, RCRA) that are operating in lieu of the federal program be at least as stringent as the federal program. It

does not change the federally mandated, program-specific administrative, technical and notification requirements on either a remediating party or regulators." Similar statements can be found throughout the guidance. The department believes that the guidance meets federal laws and regulations in its existing MRBCA guidance and is consistent with the National Contingency Plan (NCP) as codified in 40 CFR Part 300.

In the spirit of an open process, this guidance was developed over a period of several years and used input from a large number of knowledgeable and affected stakeholders. These included responsible parties, consultants, academia, Missouri's Department of Health and Senior Services, and the USEPA. The knowledge base represented in the stakeholders group included hydrogeologists, engineers, chemists, toxicologists, risk assessors, well drillers, environmentalists, and land use developers. Thus, we believe that our final product represents the collective wisdom and experience of numerous individuals, agencies, and disciplines.

The USEPA has been a participant for some time in the Workgroup. Not only has USEPA staff attended many of the Workgroup meetings, but many have been aware that the department has been using the draft MRBCA on pilot projects in order to practically test its concepts in the field and refine them as needed. USEPA staff has been involved in many of the meetings with remediating parties.

I have attached the department's responses to specific USEPA comments. Again, thank you very much for your review and comments. We hope that we can move forward in satisfactorily finalizing Missouri's Risk-Based Corrective Action Technical Guidance. If you have questions or concerns, please contact me or Linda Vogt of my staff at the Hazardous Waste Program, P.O. Box 176, Jefferson City, MO 65102-0176 or by telephone at (573) 751-2747.

Sincerely,

HAZARDOUS WASTE PROGRAM

Robert Geller
Interim Director

RG:lvj

c: Daniel R. Schuette, Interim Division Director, ALPD
John Madras, Environmental Policy Director, ALPD

Attachment

EPA Comments of April 24, 2005 and subsequent correspondence received on June 23 and July 15, 2005 and the Department's response to specific comments

1. When the agency conducts a Remedial Investigation (RI) and Feasibility Study (FS), the regulations require that a baseline risk assessment be completed. (40 CFR Part 300.430(d)(4)). As part of the RI/FS and Risk Assessment process the agency must evaluate actual and potential exposure pathways through environmental media (40 CFR Part 300.430(d)(2)(v)); actual and potential exposure routes, for example, inhalation and ingestion (40 CFR Part 300.430 (d)(2)(vi)); and other factors such as sensitive populations (40 CFR Part 300.430 (d)(2)(vii)).

   MDNR Response to EPA Comments of April 24: The MRBCA process meets all the requirements in 40 CFR Part 300.430(2) (characteristics of site and waste, evaluation of current and future exposure pathways, exposure routes, and sensitive populations). With further evaluation, the MRBCA tiered approach leads to the same conclusions. The process has been streamlined to result in target cleanup levels within the risk range contained in the NCP, as opposed to first estimating baseline risk and then estimating target levels if necessary.

   The USEPA has accounted for sensitive populations (children, pregnant women, and older individuals) in the derivation of toxicity values. In the Risk Assessment Guidance for Superfund (RAGS) Volume I, Part A Human Health Evaluation Manual (USEPA, 1989) the following definition of chronic reference dose includes the sensitive receptors:

   > ***<u>Chronic Reference Dose (RfD)</u>. An estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (as a Superfund program guideline, seven years to lifetime).***

   Because MRBCA uses the hierarchy of toxicity values recommended by the Human Health Toxicity Values in Superfund Risk Assessments (USEPA, 2003), we also account for the same sensitive populations in an equivalent fashion. MRBCA also accounts for a child receptor in the residential scenario.

   40 CFR Part 300(b)(7) of the NCP also provides for the evaluation of Natural Resource Damage Assessment and Restoration (NRDAR). Under authorities such as CERCLA, RCRA, Clean Water Act, and RSMo 644.096, NRDAR can be pursued at any site in which natural resources have been injured. MRBCA does not address NRDAR; however, it does not preclude the department from pursuing damages on state-lead sites that have significant natural resource injuries, which may be determined through a baseline risk assessment.

2. The regulations provide that for systemic toxicants, acceptable exposure levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (40 CFR Part 300.430(e)(2)(i)(A)(*1*)). The factors as outlined here are the basis for the Agency using the reasonable maximum exposure scenario (RME) and for calculating risk based on a lifetime exposure scenario. The risk assessment and cleanup level selection process set forth in the MRBCA Guidance may conflict with these federal requirements.

MDNR Response to EPA Comments of April 24: *As* ***discussed in our response to Comment 1, the definition of reference dose accounts for sensitive subgroups (children, pregnant women and older individuals).***

In developing the RME scenario, USEPA generally considers the upper bound (90th or 95th percentile) values for each of the factors (exposure duration, skin surface area, exposure frequency, inhalation rate, etc.) included in the dose equation. To estimate the dose, all of these factors are multiplied together. Multiplication of these factors, several of which are highly unlikely (90th to 95th percentile value), results in a scenario that has minimal probability of occurring. Thus, from a purely statistical perspective, EPA's RME case is statistically improbable.

USEPA's RME scenario for residential land use assumes a person stays indoors in the same house for 30 years, 350 days/year and 24 hours/day. The department's MRBCA assumes that an individual stays indoors in the same house for 30 years, 350 days, and 18 hours/day, which we believe to be more reasonable.

		USEPA	***Department***
ED	***=***	***30 years***	***30 years***
ET	***=***	***24 hours/day***	***18 hours/day***
EF	***=***	***350 days/year***	***350 days/year***

In an effort to streamline the process of estimating site-specific target levels, the department has chosen to use more realistic yet still adequately conservative exposure factors for the majority of sites.

The MRBCA process requires that, on sites where the above assumptions are not valid, site-specific factors may be used. On page 10-1, the guidance states that site-specific exposure factors may be used in Tier 3 risk assessment. Thus, the department has the flexibility on a site-specific basis to use more conservative exposure factors if warranted. The MRBCA process does not use unrealistically conservative exposure factors at every site. Use of these factors would significantly increase the cost of clean-ups without a commensurate benefit.

The department developed a table, Attachment A, Comparison of Exposure Factors, which compares the exposure factors recommended by EPA and the default values used by MRBCA. Examination of this table indicates that the majority of the MRBCA

default exposure factors are consistent with the EPA recommended exposure factors. This table is discussed in more detail in our response to USEPA Comment 9.

3. For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10-4 and 10-6 using information on the relationship between dose and response. Perhaps most significantly, the regulations provide that the 10-6 risk level shall be used as the point of departure for determining remediation goals when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure (40 CFR Part 300.430(e)(2)(i)(A)(*2*)). The MRBCA guidance which uses 10-5 as point of departure may present a conflict with this section of our federal regulations.

MDNR Response to EPA Comments of April 24: *We* ***do not see a conflict between the MRBCA and federal regulations. We are aware that the NCP process presents a range of acceptable risk levels for carcinogens from 1 x 10^{-4} to 1 x 10^{-6} and that 1 x 10^{-6} risk level is used as the point of departure. However, the department chose to use a single target risk level of 1 x 10^{-5} which is within the NCP's range of acceptable levels. Acceptable risk levels adopted in other states also range from 10^{-6} to 10^{-4}.Further the MRBCA process contains provisions to assess cumulative risk from exposure to multiple contaminants and explicitly states that in no case shall the risk for carcinogens exceed 1 x 10^{-4}, which is consistent with the risk range in the NCP. Ultimately, the point of departure is in many respects irrelevant as long as the final cleanup levels fall within the acceptable risk range. Furthermore,***

(i) Given the number of impacted sites and the available department resources, it is not practical or desirable for the department to negotiate an acceptable risk level for each site individually.

(ii) Several recent EPA/regulations have focused on a risk of 1 x 10^{-5} and even 1 x 10^{-4} and very rarely on 1 x 10^{-6} as an endpoint for acceptable risk level.

(iii) Compared with the background level of cancer risk (1 in 3) and the social cost of cleanups, the department believes that cleanup to 1 x 10^{-5} is reasonable, practical, conservative and cost effective. In fact, Kathryn E. Kelly, Dr. P.H., stated, "Lifetime exposure to a substance associated with a risk of 10^{-6} would increase our current chances of developing cancer from all causes (which are 1 in 3, or 3.33 x 10^{-1}) by a mere 0.00003%." (<u>The Myth of 10^{-6} as a Definition of Acceptable Risk</u>, presented at the Air & Waste Management Association in June 1991).

(iv) Dr. Kelly's paper concludes that. "Accordingly, the benefits of the 10^{-6} as a criterion applied to hazardous waste sites will rarely exceed the risks and costs, and the criterion is thus unsuitable for regular implementation or enforcement."

4. With respect to ARARs, the NCP sets for an expectation that usable aquifers will be restored where practicable, and that maximum contaminant level goals (MCLGs) established under the Safe Drinking Water Act, that are set at levels above zero, shall be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water, where the MCLGs are relevant and appropriate based on factors in 300.400(g)(2). In addition, the NCP provides that water quality criteria established under sections 303 or 304 of the Clean Water Act shall be attained where relevant and appropriate. See 40 CFR Part 300.430(e)(5)(E). These provisions of the NCP could potentially conflict with the MRBCA should a cleanup level be developed that is less stringent than MCLs. MCLGs, or the water quality criteria established under the Clean Water Act.

   MDNR Response to EPA Comments of April 24: We agree that remedial actions for ground or surface waters that are current or potential sources of drinking water should be restored to MCLs where practicable. MRBCA sets up clear expectations and a process to define "usable" aquifers under both current and future conditions where MCLs may apply. At the same time, it allows for flexibility to determine acceptable cleanup levels in other types of subsurface water-bearing zones that may not be used for drinking water but where direct contact, volatilization of contaminants to indoor air, or groundwater/surface water interaction may be a concern. We also agree that cleanup criteria should be no less stringent than any water quality criteria established in Missouri under the Clean Water Act if an exposure pathway is complete. The MRBCA provides for both in Section 5.4 and Section 6.6.

   In addition to the above, prior to the issuance of a Letter of Completion, the MRBCA process requires that the groundwater plume, if one exists, be stable or decreasing. This condition will ensure that the concentration in the future will continue to decrease beyond the applicable risk based levels, i.e., MCLs or equivalent for potential sources of drinking water.

   We also call the USEPA's attention to the following statements from the California Center for Land Recycling (CCLR). CCLR is a statewide nonprofit organization focused on creating sustainable communities by identifying and implementing responsible patterns of land use and development. In Chapter 4 of a publication entitled <u>Strategies for Promoting Brownfield Reuse in California (CCLR, October 1998)</u>, it states, "As a matter of policy, the U.S. EPA has begun to depart from the NCP's approach in recent years. Attaining traditional cleanup standards, particularly for groundwater contamination, has proven technically and economically infeasible in many instances… The EPA has started to allow cleanup standards that are tailored to a property's designated end uses as long as the standards remain within the NCP's risk range. California, like most states, has followed this lead."

   With respect to comments 1-4 above, this publication further states, "Many states have adopted, or are in the process of adopting, formal risk-based decision making methodologies into their cleanup operations. Some are using the Risk-Based Corrective Action (RBCA, pronounced "Rebecca") protocol originally developed by the

American Society for the Testing of Materials (ASTM) for use at leaking underground storage tank sites. Others are designing their own protocols based on RBCA principles."

RISK ASSESSMENT COMMENTS

Critical Comments

1. The MRBCA guidance makes no mention of the EPA's requirement for the evaluation of the reasonable maximum exposure (RME) scenario in risk assessment. The EPA guidance defines the RME as "the highest exposure that is reasonably expected to occur at a site. RMEs are estimated for individual pathways. If a population is exposed via more than one pathway, the combination of exposures across pathways also must represent an RME". The EPA's guidance goes on to say that "The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures" (EPA, 1989). Although current EPA policy is to present Central Tendency Estimates (CTE) in risk assessments in order to "give the risk manager additional information to consider while making decisions at a site", pursuant to the NCP "decisions at Superfund sites are based on cancer risks and non-cancer health hazards associated with RME estimates under both current and future land use conditions" (EPA, 2004a). ***We strongly advocate modifying the MRBCA guidance to retain this important information.***

   MDNR Response to EPA Comments of April 24: Please refer to our response to Comment 2 above regarding our view on RME. In an effort to streamline the process, MRBCA does not require that risk assessments be conducted for both the CTE and RME cases at all sites. However, on a case by case basis, MRBCA process gives the department's project managers the latitude to request a risk evaluation for alternative input parameters to get an understanding of the range of risk that may be present at a site. Thus the project manager at some sites may require risk results for both the CTE and RME cases.

   EPA Reply of July 13, 2005: This issue remains an area of significant technical disagreement. During the June 15 conference call, MDNR indicated that while the guidance document does not require the use of the RME scenario, flexibility exists for the site project manager to request that the RME scenario be used. MDNR also noted, in the June 15 conference call, that although the acronym "RME" is not used in the MRBCA document, the assessment procedures used in the MRBCA are sufficiently conservative so as to constitute an RME scenario.

   In order to evaluate MDNR's assertion that the guidance provided for the functional equivalent of an RME, EPA compared the requirements for calculating potential human health risk based on EPA's recommended RME scenario with the

requirements presented in the MRBCA guidance document. In EPA's Risk Assessment Guidance for Superfund (RAGS) Part A, (EPA 1989) the text states "For Superfund exposure assessments, intake variable values for a given pathway should be selected so that the combination of all intake variables results in an estimate of the reasonable maximum exposure for that pathway". The reasonable maximum exposure is accordingly defined as "the highest exposure that is reasonably expected to occur at a site." This RME is to be evaluated in both current and future use scenarios. In presenting the generic intake equation, RAGS Part A identifies three categories of variables which are included in the development of any exposure scenario, particularly the RME scenario: exposure concentration, variables that describe the exposed population, and averaging time.

1. Exposure concentration. RAGs defines the first of these variables, exposure concentration, as "a reasonable estimate of the arithmetic average concentration likely to be contacted over time." RAGs further clarifies that "Because of the uncertainty associated with any estimate of exposure concentration, the upper confidence limit (i.e., the 95 percent upper confidence limit [UCL] on the arithmetic average) will be used for this variable." There are several statistical methods capable of calculating a 95% UCL of any given data set, many of which are presented in EPA document "ProUCL Version 3.0 User Guide", EPA/600/R04/079. The ProUCL software contains fifteen UCL computation methods, and recommends the most appropriate 95% UCL for use as the exposure point concentration based on site-specific sampling results.

The MRBCA guidance document, on the other hand, does not make use of the 95% UCL, but instead recommends the use of a simple arithmetic average of site-specific sampling results, assuming biased sampling. However, depending on the adequacy of the sampling effort, use of the arithmetic average is likely to understimate the mean contaminant concentration at the site. While both RAGS and MRBCA use the mean concentration from site-specific sampling results, the MRBCA process does not account for the uncertainty inherent in virtually all sampling designs. By using a simple arithmetic average concentration, as specified in the MRBCA document, an investigator has no way to determine whether the true mean of the contaminant concentration has in fact been identified by a particular sampling effort. In contrast to the MRBCA approach, by using the ProUCL software, an investigator is confident at the 95% level that the sampling effort has identified the true mean contaminant concentration. This discrepancy between the 95% UCL of the true mean, and the arithmetic average concentration, is heavily influenced by sample size with larger discrepancies being associated with smaller sample sizes. Anecdotally, it is appropriate to point out that, due to resource constraints, it is not unusual for the number of samples taken at any given facility or exposure area to be relatively small.

2. Exposed population. The second category of intake variables discussed in RAGS includes variables that describe the exposed population. These variables include such parameters as contact rate, exposure frequency and duration, and body weight. For each of these variables, EPA guidance documents present default values which are to be used unless site-specific values can be shown to be more representative,

based on rigorous site-specific data collection and evaluation. The default values found in EPA guidance are conducive to the development of a RME scenario.

The MDNR response to EPA's comments presents, in Attachment A, a comparison of the MRBCA default values with EPA default values. From this table, it can be seen that in a number of instances, the MRBCA default values are less protective than the EPA RME default values. For example,

a) The MRBCA document cites as "Not Available" default values for the "Event Frequency for Dermal Contact with Groundwater" pathway, while RAGS Part E contains a default value of 1 event/day.

b) The MRBCA document differentiates between "Exposure Time for Dermal Contact With Groundwater" and "Event Duration for Dermal Contact With Groundwater." Given that the most likely pathway for dermal contact with groundwater is by showering, and given that EPA default values exist for "Event Duration" in a showering scenario, we fail to understand the reason for inclusion of the "Exposure Time" parameter.

c) The MRBCA document maintains that default values for "Event Duration for Dermal Contact with Groundwater" are also not available, while RAGS Part E specifies a t_{event} default value of 0.58 hour/event and 1.0 hour/event for adult and child residents, respectively.

d) EPA guidance (1991), recommends default inhalation rate values of 10 m^3/d and 20 m^3/d for children and adults, respectively. The MRBCA document presents hourly inhalation rates for child residents, and adult residents and workers, of 0.416 m^3/d and 0.833 m^3/d, respectively. While at first glance, the MRBCA hourly values may appear to be as protective as the default EPA values when evaluated over the course of a 24 hour day, such is not the case. EPA guidance specifically states that 20m^3/d is representative of "a reasonably conservative inhalation rate for total (i.e., indoor plus outdoor) exposures at home and in the workplace" (EPA 1991). In other words, EPA's RME inhalation rate values of 10 m^3/d and 20 m^3/d already take the factors into account which the MRBCA document purports to address.

e) Unlike EPA guidance, the MRBCA guidance differentiates between time spent in the home and workplace, and time spent indoors and outdoors. By combining this approach with hourly inhalation rates, when evaluating a chronic toxicity scenario, the MRBCA document uses lower daily inhalation rates than those found in EPA guidance. This is primarily the result of the MRBCA document once again using average exposure values, rather than taking an RME approach. For example, the MRBCA document assumes that all adults are absent from the home for six hours per day. However, this approach does not take into account residents that may be unable to leave the home on a regular basis, such as the elderly, the disabled, people with chronic illnesses, infants, etc. These subpopulations of potential concern may be at increased risk from chemical exposures for a variety of reasons, including increased sensitivity or behavior patterns that may result in high exposure. While EPA's RME approach takes sensitive subpopulations into account (EPA 1989), the MRBCA approach of focusing on average individuals and exposures does not.

f) the MRBCA category "Skin Surface Area for Dermal Contact with Soil/Groundwater" references the EPA default skin surface area values for contact with soil. However, the document makes no reference to EPA default skin surface area values for contact with water. Because the skin surface area exposed to water, for example during showering, is much greater than the skin surface area exposed to soil, the values found here in the MRBCA document will underestimate exposure to contaminants in groundwater. We also note here that the MRBCA document does not appear to identify any exposure factors for use in evaluating potential contact with contaminated surface water.

g) similarly, the MRBCA document's derivation of inhalation rates for construction workers, in Appendix B, does not utilize RME values. The MRBCA document presents both mean and 99th percentile default inhalation rate values. However, the value used in the final risk equations is an "Average Inhalation Rate", based on the time-weighted averaging of mean inhalation rate values. In contrast, EPA guidance states that, when calculating RME exposure, "In general, use 95th or 90th percentile values for contact rate and exposure frequency and duration variables." (EPA 1989)

3. Averaging time. The averaging time presented in the MRBCA document for carcinogens is consistent with the value used by EPA. However, for non-carcinogens, EPA computes averaging time using the formula ED x EF, primarily for unit conversion purposes.

MDNR Response to July 13, 2005 Reply: **The EPA defines the reasonable maximum exposure as "the highest exposure that is reasonably expected to occur at a site." The department notes that a key word in the EPA definition is "reasonable." The department continues to believe that its exposure scenario is reasonable. Specific responses below:**

1. 2. a), b) and c). The department considers these default values as "not available" to its Technical Guidance because they have not been assigned values as yet. These exposure pathways were not contained in the draft guidance. However, RAGS E was adopted by the Risk-Based Remediation Rule Workgroup at its May 28, 2005, meeting; therefore, the department plans to populate these values at its August 23, 2005 meeting. As in the past, these values have always been discussed within the stakeholder Workgroup.

1. 2. d) and e) We agree with EPA that the MRBCA exposure factors do not account for individuals who remain confined indoors with windows always closed for 24 hours/day for 350 days/year continuously for 30 years. An individual who meets these criteria would indeed be very rare and possibly non-existent. We believe it is not good public policy to develop a clean-up program based on unrealistic assumptions.

1. 2. f) As has been pointed out, the draft MRBCA Technical Guidance did not incorporate the dermal exposure methodology presented in RAGs Part E, which was adopted at the Workgroup meeting on April 28, 2005. Further the dermal pathway

included in the draft MRBCA refers to incidental exposure to soil and groundwater and surface water.

At the August 23, 2005 meeting, all aspects related to dermal contact with soil and groundwater will be discussed. At the end of this meeting, we hope to have a more comprehensive understanding of the dermal exposure issues, including the default parameters.

1. 2. g) Department staff met with the Department of Health and Senior Services (DHSS) staff on June 3 to discuss the USEPA comments. At that meeting, it was decided to evaluate an hourly outdoor inhalation rate of 1.8 m^3/hr and an exposure time for outdoor inhalation of 10 hours/day for the construction worker and to bring that to the next Workgroup meeting for discussion (see Attachment B). This inhalation rate is based on the following consideration.

> ***Table 5-23 Summary of Recommended Values for Inhalation from EPA's Exposure Factors Handbook Volume I General Factors (1997) lists the following mean inhalation for outdoor workers:***
>
> | | |
> |---|---|
> | ***Slow Activities*** | ***1.1 m^3/hr,*** |
> | ***Moderate Activities*** | ***1.5 m^3/hr, and*** |
> | ***Heavy Activities*** | ***2.5 m^3/hr.*** |

We assumed that a construction worker spent 2 hours/day for slow activities, 4 hours/day for moderate activities, and 4 hours/day for heavy activities. As described in Attachment B, using the EPA's recommended inhalation rates over a 10-hour workday, an average weighted inhalation rate of 1.8 m^3/hr was developed for the construction worker.

The use of activity-pattern weighted inhalation rate is consistent with common practices, including EPA's. Refer to Attachment A Activity Specific Inhalation Rates of OSWER Directive 9285.6-03 (Mar 25, 1991).

1. 3. averaging time: The MRBCA process and EPA use exactly the same procedure for estimating the averaging time.

2. The MRBCA guidance includes as part of the Tier 1 risk assessment a comparison of relevant risk-based target levels with "representative concentrations" of site contaminants of concern (COCs; see for example, Section 2.2.5). Appendix C of the guidance defines a representative concentration as "the average concentration to which the receptor is exposed over the specified exposure duration, within a specified geographical area, and for a specific route of exposure". For example, item five in Appendix C states "when calculating the representative groundwater concentration, first estimate the average

concentration in each well based on recent data …. And then use the average of each well to estimate the representative concentration." The use of average contaminant concentrations in evaluating risk conflicts with EPA policy and guidance (not entirely so, see above comment). In its comparison with target levels, the "representative concentration" discussed here is analogous to EPA's exposure point concentration. Rather than deriving an average exposure point concentration, EPA guidance states that "Because of the uncertainty associated with estimating the true average concentration at a site, the 95 percent upper confidence limit (UCL) of the arithmetic mean should be used for this variable (EPA, 1992)." For exposure areas with limited amounts of data or extreme variability in measured or modeled data, the maximum contaminant concentration may be used in lieu of the 95% UCL (EPA, 1992). The EPA has made available the ProUCL software package to assist in the calculation of upper confidence limits for various data sets (EPA, 2004b). ***EPA strongly urges that the MRBCA guidance be revised to be consistent with EPA guidance through the use of a UCL of the arithmetic mean (or maximum contaminant level where limited data exists).***

MDNR Response to EPA Comments of April 24: *It* ***is the department's understanding that the calculation of the 95 percent upper confidence limit (UCL) of the arithmetic mean is a valid calculation if (i) the concentration data is collected in unbiased manner, and (ii) sufficient data is available to calculate the 95 %UCL. However, the departmental guidance assumes biased sampling coupled with the concept of sufficient samples. With site characterization and delineation requirements, the data available will be biased, that is, it will include spatial and temporal trends and hence calculation of the 95% UCL would not be appropriate.***

The concept of using arithmetic and weighted average concentrations in the evaluation of risk has precedent in some of USEPA's existing guidance. Discussion of using averages as opposed to 95% UCLs can be found in the July 1994 Guidance for Measuring Lead in Soil and Paint to determine inputs to EPA's Integrated Uptake Biokinetic Model for evaluation of lead exposures. More extensive discussion of using averages to develop representative concentrations can be found in USEPA's 1996 Soil Screening Guidance.

One of the primary tenets of using averages, as expressed in the MRBCA guidance, is that such averages be developed only across areas of impact (i.e., averages are not to be artificially "diluted" by the inclusion of non-detect values outside the area of impact.) Also, if regular "gridded" sampling data is not available across an area of impact, the guidance recognizes that use of area weighted averages may be appropriate to ensure that the average used to assess risk is not artificially skewed.

Further, to ensure that the concept of average is not misused, the department requires that if the ratio of the maximum concentration within any exposure domain to the average concentration exceeds 10, the data must be re-evaluated. This "rule of thumb" provides an additional safeguard in the MRBCA process.

EPA Reply of July 13, 2005: Similar to the previous issue, there continues to exist significant technical disagreement with respect to the appropriateness of using an arithmetic mean vs. a 95% UCL. EPA's rationale has been provided in the previous response. To address EPA's concerns all references to the use of the arithmetic mean can be modified to indicate that the 95% UCL of the mean should be used. A short sentence explaining the concept and a reference to EPA's ProUCL Version 3.0 User Guide, EPA/600/R04/079 should be included where the concept is first discussed.

MDNR Response to July 13, 2005 Reply: The department recognizes that sufficient data must be available to minimize concerns about the representativeness of data. However, we reiterate that the concept of using arithmetic and weighted average representative concentrations in the evaluation of risk has precedent in USEPA's existing guidance.

In addition, as has been documented in ProUCL, there is no single unique way to estimate the 95% UCL. For data that are skewed and biased (typically characteristic of environmental data), the uncertainty in the estimate of the 95% UCL may be sufficient to make the estimate very unreliable. Hence for the majority of the sites, the process of calculating representative concentrations recommended by MRBCA (which is not the arithmetic average of all data) is reasonable, practical, unbiased, and conservative.

3. Appendix E presents toxicity values for a number of chemicals, several of which are inconsistent with those used by EPA either because they appear to rely on older data (pre-Oct 2004 EPA Region 9 PRG update) or use other sources. ***Our preference is that the MRBCA guidance maintains consistency with EPA guidance regarding the hierarchy of acceptable sources for use in obtaining toxicity values (EPA, 2003) and is updated with current EPA toxicity values.***

   MDNR Response to EPA Comments of April 24: The Risk-Based Remediation Rule Workgroup held a meeting on April 28, 2005 to discuss comments that had been received to date. Although the USEPA's comments were not received in time to be considered at that meeting, this comment had been made by another commentor, and, at that meeting, it was agreed to use the October 2004 PRG tables for toxicity values, but still consistent with the hierarchy specified in the December 5, 2003 OSWER Directive 9285.7-53.

4. The text of Section 7.2 gives several examples of data that may be eliminated from consideration, including "old data that is not considered representative of current conditions" and "data collected prior to any remediation at the site." Item 7 in Appendix C goes on to state that "in certain cases, data that [are] more than two years old may be used, but it must be justified." While EPA agrees that older data may often no longer be representative the ***EPA strongly recommends that where older data are to be excluded, the facility must provide sufficient justification as well as specific information regarding the data to be excluded.***

MDNR Response to EPA Comments of April 24: Section 7.2 states, "Any data that is not used in the quantitative risk assessment must be clearly identified and the reason for its elimination determined. This information must be clearly documented in the Tiered Risk Assessment Report." Documentation is called for throughout Section 7 whenever data or a particular chemical would be eliminated. Thus we agree that sufficient justification must be provided if any data is eliminated.

Further, old data should not be excluded from use in a risk assessment under any and all circumstances. It may be helpful to provide examples in the guidance document of circumstances where use of data greater than two years old may be appropriate. We therefore propose to include the following information in Section 7.2 of the guidance to highlight situations where use of older data for risk assessment purposes may be relevant and appropriate. We will add the following paragraphs after the third paragraph.

> ***"Where the contaminants of concern in soil or sediment do not readily degrade and/or migrate in the environment, "old data" may accurately or conservatively represent the current site conditions and therefore it would be reasonable to retain older data in assessing the risk if new data were not available. Examples of these types of contaminants are metals, some polynuclear aromatic hydrocarbons, polychlorinated biphenyls and polychlorinated dioxins and dibenzofurans. Due to their relative chemical/physical stability and hydrophobic nature, these compounds tend to stick to soil and sediment, do not migrate readily under most circumstances and, due to their stability, their concentrations in the ambient environment often remain relatively constant over long periods of time. Given this, use of "older" soil and sediment data in assessing risks related to these compounds may be entirely appropriate.***
>
> ***However, some contaminants of concern in soil or sediment do readily volatilize, degrade and/or migrate in the environment, such as many petroleum hydrocarbon and volatile compounds including chlorinated solvents. Without the benefit of additional and more current data collection, use of old "data" for these types of compounds would be a "worst case" scenario, assuming no new spills or leaks since the old data was collected. The assumption is that the concentration at a site is probably less than what it was in the past, so if the risk assessment uses older (higher) concentration data and shows that the risk is acceptable using those concentrations, then the risk associated with what remains should also be acceptable. This approach must be carefully evaluated and must consider the nature of the chemicals of concern to avoid the pitfall of underestimating risk, such as when TCE is transformed to the more toxic vinyl chloride. In this case, use of old data could provide a false sense of acceptability if much of the TCE has been converted to vinyl chloride (which could only be known using more recent samples). In the case of petroleum hydrocarbons, the reverse could be true in that we would expect lower, less toxic concentrations over time (as evidenced by all the studies supporting environmental degradation of such compounds) .***

The foregoing examples are by no means all-inclusive but highlight a few considerations in the use of older data. The use of older data for the purpose of risk assessment should in no way be confused with the use of older data for other purposes. All data are integral to the site-specific understanding of contaminant fate and transport. In investigation, older data must be used to assess and depict longer-term contamination trends in soil, sediment, surface water and groundwater. In remediation, older data often represent the "starting point" in developing chemical mass balance (contaminant recovery/treatment), estimated remediation timeframe and groundwater plume stability determinations."

EPA Comment of June 23, 2005: EPA would be in agreement if the following two changes were made:

- Modification of the last sentence of the last paragraph of Section 7.2 to read as follows:

  This information must be clearly documented in the Tiered Risk Assessment Report, and the data made available at the request of the department.

- Modification of the second bullet of Section C.3. to read as follows:

  If the data are old (greater than four years old) and the COC concentrations exceed Tier 1 Risk Based Target Levels, new data may be collected (especially groundwater data). If a new release has been documented, new data must be collected in order to characterize accurately the nature and extent of the release.

  If old data are to be eliminated from the risk evaluation, the reason for its elimination must be clearly documented in the Tiered Risk Assessment Report (see section 7.2 of the MRBCA guidance).

MDNR Response to June 23, 2005 Comment: The department will modify the second bullet of Section C.3. to read as follows:

- ***If the data are old (greater than four years old) and the COC concentrations exceed Tier 1 Risk Based Target Levels, new data may be collected (especially groundwater data). If a new release has been documented, new data must be collected in order to characterize accurately the nature and extent of the current impact. If old data are to be eliminated from the risk evaluation, the reason for its elimination must be clearly documented in the Tiered Risk Assessment Report (see section 7.2 of the MRBCA guidance).***

5. The MRBCA guidance contains contrary language in Section 8.7 concerning the calculation of site-wide risks. The bulleted items state that the cumulative site-wide carcinogenic risk must not exceed 10^{-4}, while the cumulative site-wide hazard index must not exceed 1.0. However, the next paragraph appears to indicate that Step 6 (i.e., the calculation of site-wide risks) "will apply only in cases where the number of COCs and routes of exposure may warrant the calculation of cumulative site-wide risk". The first full sentence on the next page goes on say that Step 6 would be needed only in "rare" instances. ***The EPA firmly believes that in order to adequately evaluate any potential concerns about additivity of risk across a site, the inclusion of a cumulative site-wide risk assessment must be calculated. The guidance should be modified to indicate that calculation of cumulative site-wide risk is the norm.***

   MDNR Response to EPA Comments of April 24: The department's methodology, while requiring less work and time than the USEPA's approach, accomplishes the same level of protectiveness.

   For chemicals regulated as carcinogens the MRBCA process requires that two conditions related to target risk (note there are additional conditions that have to be met to get a letter of completion) be satisfied for each receptor:

   (i) The total risk for each chemical of concern, which is the sum of risk for all the complete routes of exposure for each COC, must not exceed 1 x 10^{-5}, and

   (ii) The cumulative site-wide risk (sum of risk for all COCs and all complete routes of exposure) must not exceed 1 x 10^{-4}.

   Thus if the sum of the number of COCs and the complete routes of exposure is less than 10, then meeting the first condition will ensure that the second condition is also met. In such situations it is not necessary to estimate cumulative risk.

   Based on the above observation we believe that there is no contradictory language in the MRBCA process. Although we believe the need for this additional calculation will not arise frequently, we will remove the word "rare".

   EPA Reply of July 13, 2005: EPA continues to believe that the calculation of site-wide risk is appropriate and necessary for all sites, not just those where the number of COCs and pathways exceeds 10. Since such a calculation requires little effort to arrive at a sum given today's use of spreadsheets and software, no additional burden will result. When asked to evaluate multiple remedies, a site manager deserves to know whether site-wide risk is, for example, 1.4×10^{-5} or 9.5×10^{-5}, rather than only knowing risk does not exceed $1 \times 10^{-4.}$ Additionally, the public is better served by a process that explicitly and transparently portrays site-wide risk. To address EPA's concerns, the document should be modified to require calculation of site-wide risk.

MDNR Response to July 13, 2005 Reply: Where risk is being calculated at sites, the department agrees that the site-wide risk can be calculated easily by the use of a spreadsheet. Therefore, we are willing to re-open this discussion with the Workgroup to discuss if it would be valuable to provide this information in a tiered risk assessment report .

6. Appendix E. All the equations which incorporate the dermal contact factor appear to have been taken from RAGS Part A. The dermal contact portions of RAGS Part A have been superseded by RAGS Part E (EPA, 2004c). ***All of these incorrect equations need to be revised to incorporate the most recent EPA guidance.***

   MDNR Response to EPA Comments of April 24: The dermal contact factors were in accordance with USEPA guidance available at the time that the Risk-Based Remediation Rule Workgroup made its decisions on these issues. As noted earlier, the Workgroup held a meeting on April 28 to discuss comments that had been received by the deadline of March 28, 2005. Although the USEPA's specific comments were not received in time to be considered at that meeting, this comment was also made by another commentor, and, at that meeting, it was agreed to use RAGS Part E (USEPA, 2004).

7. The text in Section C.2.2.2 discusses the use of the Johnson and Ettinger model to estimate subsurface soil concentrations protective of indoor air inhalation. ***The EPA recommends that the text be modified to discuss the collection of indoor air samples in addition to use of the model.*** The EPA guidance recommends that site-specific indoor air sampling be conducted as a complement to the use of the model, and to verify the accuracy of the model's site-specific predictive capability (EPA, 2002.). We have experience with several sites throughout the region where indoor air sampling documented contamination at levels of concern when the Johnson and Ettinger model indicated otherwise.

   MDNR Response to EPA Comments of April 24: The MRBCA guidance does not preclude the use of site-specific indoor air sampling. However, we are aware of a number of confounding factors that make the results of indoor air measurements difficult to use as a source of information to determine risk due to subsurface impacts below or adjacent to structures . Among these: 1) other anthropogenic indoor air sources, 2) defining background, 3) detection limits above PRGs/screening levels, 4) diurnal and seasonal variability, and inability to measure indoor air concentrations at proposed buildings. Recognizing these technical difficulties and the potential for causing unnecessary inconvenience to the occupants, we believe this type of analysis would not be routinely used when evaluating this pathway.

   The guidance provides for a second step, soil gas sampling, when information is needed to supplement the model results. Thus the guidance provides for a step by step approach to evaluate the indoor inhalation pathway and is consistent with the approach discussed in USEPA's draft "Indoor Vapor Intrusion Guidance Document."

The wide-reaching nature of the document is such that it cannot provide detailed guidance for all situations. Ttherefore, a detailed and exhaustive discussion of topics such as evaluation of risk due to indoor inhalation or specific guidance for indoor air sampling would not be appropriate in this guidance and, if needed, would be part of a site-specific analysis. However, the following paragraph can be added to Appendix E, pp. E-3, before the heading on "Other Pathways."

> ***"The evaluation of the indoor vapor intrusion pathway, i.e., the migration of volatile chemicals from subsurface soil or groundwater is currently an area of major research and discussion. Depending on a variety of site-specific factors, the evaluation of risk from this pathway may include the measurement of soil vapor concentrations, described in Appendix H, and/or indoor air concentrations. Department staff and remediating parties should carefully evaluate the pros and cons of performing such measurements and the ability of this data to develop more accurate risk-based target levels at a site before undertaking such measurements."***

EPA Reply on July 13, 2005: EPA believes that the paragraph provided by MDNR to be added to Appendix E, pp. E-3, before the heading on "Other Pathways," is an appropriate edit, however it should also indicate that the use of the Johnson and Ettinger Model is also not without its limitations and subsequent pros and cons. Additionally the following edits should be made:

1. Modify Section 6.14 to read as follows:

a) Section 6.14 Distribution of Chemicals of Concern in the Vapor Migration to Indoor Air Pathway

b) For sites where soil or groundwater concentrations result in the exceedance of Tier 1 risk levels for the vapor migration to indoor air pathway, modeling, soil vapor monitoring, and/or foundation (crawlspace and subslab)/indoor air sampling may be conducted on a site-specific basis. For further details, refer to Appendix H and relevant state and federal guidance, such as the most current version of USEPA's *Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway form Groundwater and Soils*. Soil vapor sampling and/or foundation/indoor air sampling methodologies would be included in a data collection work plan.

MDNR Response to July 13, 2005 Reply: Section 6 will be modified in the following manner:

> ***The title of Section 6.14 will be changed to read, "Distribution of Chemicals of Concern in the Vapor Migration to Indoor Air Pathway."***

The language will be modified to read:

"For sites where soil or groundwater concentrations result in the exceedance of Tier 1 risk-based target levels for the vapor migration to indoor air pathway, additional tools and methodologies such as modeling, soil vapor monitoring, and/or foundation (crawlspace and subslab)/indoor air sampling may be considered on a site-specific basis and implemented as appropriate. For further details, refer to Appendix H and relevant state and federal guidance, such as the most current version of USEPA's Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway form Groundwater and Soils. Soil vapor sampling and foundation/indoor air sampling methodologies would be included in a data collection work plan."

EPA Reply on July 13, 2005: 2. When developing Appendix H, the Appendix should address the vapor intrusion pathway and not be limited solely to a detailed approach for soil vapor sampling. A better approach may be to modify the Appendix to address all three approaches (modeling, soil vapor sampling, and indoor air monitoring) so that their respective limitations and assumptions are each clearly described in one location. Also, the Appendix should not implicate soil vapor sampling as the last step in evaluating the vapor intrusion pathway. Soil vapor sampling is not without its limitations and may not be the preferred approach at all sites. The Region offers it's assistance to MDNR in adopting and streamlining relevant portions of USEPA's *Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway form Groundwater and Soils* for use in Appendix H.

MDNR Response to July 13, 2005 Comment: Appendix H was developed to address a specific lack of information for Missouri's contractors about soil vapor sampling. It was never intended to be an all-inclusive guidance on evaluating vapor intrusion to indoor air. It was developed by the Tanks Section of the Hazardous Waste Program This same appendix is part of the Tanks MRBCA and has been available on the web for public comment. Specific comments about this Appendix should be addressed to John Balkenbush, Tanks Section Chief.

8. Section E.1 of the MRBCA guidance appears to omit the visitor and trespasser scenarios evaluated through the conduct of a traditional risk assessment consistent with RAGs. Although the risks associated with these scenarios typically are not used in establishing clean-up numbers, they are important to retain when evaluating risks using site-specific approaches since these scenarios may be the only ones that are uncontrollable, and might factor into the choice of corrective measures. ***The EPA recommends the MRBCA be modified to include both the visitor and trespasser scenario.***

MDNR Response to EPA Comments of April 24: The departmental MRBCA does not omit consideration of any human receptor who may be exposed to site-specific chemicals, i.e., for whom an exposure pathway is complete. MRBCA requires that all receptors be considered. However, to streamline the process of risk-based decision making at a site and to avoid unnecessary calculations and the associated costs, MRBCA requires that the risks and target levels be considered only for the receptors

that are critical in the determination of corrective actions and risk management at a site. In general, the scenarios and receptors evaluated in MRBCA are more conservative and therefore more protective (i. e., the risk drivers) than a trespasser or visitor scenario.

However, if visitors and trespassers are the likely "risk drivers" and likely to determine the corrective measures, they must be evaluated. Such an occurrence is very site-specific (and hence no default values are provided) and must be evaluated as a Tier 3 risk assessment. Tier 3 risk assessment allows the use of site-specific exposure factors and receptors.

EPA Reply of June 23, 2005: EPA would be in agreement if the third paragraph of Section E1. were modified to read as follows:

> While the use of these five receptors is appropriate for many situations, other exposure scenarios (i.e., trespassers, recreational) may need to be considered where the combination of presumptive remedies, predicted future use, and use limitations may render the pathways to these five primary receptors incomplete, but for which other receptor's scenarios are still complete.

Additionally, if similar language exists elsewhere in the document discussing use of only the 5 primary receptors please include similar language as above.

MDNR Response to Comment of June 23, 2005: Although this information is stated on page 10-1 of the guidance, we can provide further information in Appendix E.1, page E. 3, under the heading of "Other Pathways."

"The tiered MRBCA process requires the consideration of all human receptors who may be exposed to site-related COCs. In residential land use scenario, these include child, adult, and age-adjusted human receptor. In a non-residential land use scenario, these include the adult worker. In both the residential and non-residential land use scenarios, exposure and risk to an occasional visitor and a trespasser are not quantitatively evaluated because the exposure and risk to the other receptors would exceed the exposure and risk to the visitor or the trespasser.

At sites where the only human receptors are a visitor, a trespasser, or a recreational visitor, their exposure and risk must be quantitatively calculated. In such situations, the exposure factors are expected to be very site-specific and hence MRBCA process does not provide any default values. Such situations must therefore be evaluated in a Tier 3 risk assessment."

9. Many of the exposure factors cited in Table E-3 are inconsistent with EPA guidance. Examples include factors for the soil ingestion rate for construction workers, inhalation rates for resident children and adults and non-residential workers, exposure times for

indoor inhalation, indoor inhalation rates, outdoor inhalation rates, skin surface area, soil to skin adherence factors, and the target risk level. ***Since the source of the values presented in this table are not identified, EPA cannot evaluate the appropriateness of their use and therefore recommends modifying the MRBCA to include exposure factors consistent with EPA guidance.***

MDNR Response to EPA Comments of April 24: The exposure factors were based on input from a number of different sources. In general these factors are within the range of reasonable yet conservative exposure factors included in USEPA's Exposure Factors Handbook (1997). It is our understanding that the Exposure Factors Handbook was compiled by USEPA to provide assistance and guidance to risk assessors in selecting exposure factors.

Attachment A, Comparison of Exposure Factors, compares the default exposure factors used by MRBCA with various USEPA published sources. Examination of these tables indicated that the MRBCA default exposure factors are consistent with the USEPA recommended exposure factors. The differences are discussed below:

- ***The hourly inhalation rate for a resident adult used by MRBCA is the same as the hourly inhalation rate used by USEPA (20 m^3/day/24 hrs/day = .833 m^3/hr). However, the department's MRBCA process assumes the residential adult spends 18 hours a day inside the residence versus 24 hours a day assumed by USEPA. We believe over a 24-year exposure duration even a sensitive receptor is not likely to spend 24 hours a day inside, hence 18 hours per day is reasonable and conservative. For a non-residential adult, MRBCA uses an exposure duration of 10 hours versus EPA's exposure duration of 24 hours a day. Similar differences are present for outdoor inhalation pathway.***
- ***Based on the Workgroups meeting, the department has agreed to adopt the RAGS Part E for evaluating dermal exposures from contact with soil and water. Thus, there is no discrepancy in the skin surface area and the soil to skin adherence factor.***

In addition, department staff met with the Department of Health and Senior Services (DHSS) staff on June 3 to discuss the USEPA comments. At that meeting, it was decided to evaluate an hourly outdoor inhalation rate of 1.8 m^3/hr and an exposure time for outdoor inhalation of 10 hours/day for the construction worker and to bring that to the next Workgroup meeting for discussion (see Attachment B).

EPA Reply in July 13, 2005 Comment: EPA reiterates its concern with respect to exposure factors that differ from those used in EPA's Risk Assessment Guidance for Superfund (RAGS) as discussed in the response to our first comment. Accordingly, this issue remains an area of significant technical disagreement. To address EPA's concerns, exposure factors should be modified to be consistent RAGS.

MDNR Response to July 13, 2005 Comment: The department does not believe that the strict application of RAGS guidance is appropriate for the vast majority of

contaminated sites in Missouri. Because of the need to efficiently and effectively promote cleanup of contaminated sites, the department believes that it is ultimately more protective of public health and the environment because sites are much more likely to enter a cleanup program voluntarily if the requirements of such are reasonable.

10. The groundwater to surface water exposure route is clearly a concern for contaminated sites with regard to ecological risk, but the potential for impacts to ecological receptors due to this exposure route is not clearly defined in Checklist A of Appendix F. ***The EPA recommends that the checklist should directly inquire as to whether there are potential surface water discharge points within any areas of groundwater contamination.***

    MDNR Response to EPA Comments of April 24: The ecological checklists provide for this concern. Level 1, Checklist A asks, "Is the boundary of the contaminated area less than ½ mile to a surface water body (stream, river, pond, lake, etc.)?" and #4. "Are there karstic features on or within ½ mile of the boundary of the contaminated area? Both of these questions establish whether potential surface water discharge points are located within any areas of groundwater contamination. If the answer to either question is yes, then Level 1, Checklist B assesses the potential exposure risk further by asking Questions 1, 2 and 7. If the answer to any of these questions is yes, then further analysis is required to assess this exposure route.

11. Checklist B of Appendix F of the MRBCA guidance addresses complete ecological exposure pathways. Clearly, whether or not a species is an ecological receptor or an area is habitat for an ecological receptor is subjective. ***Therefore, a definition of an ecological receptor and ecological receptor habitat needs to be included in the guidance.*** The EPA defines an ecological receptor as any *ecological entity exposed to a stressor* (EPA, 1997). The following is a suggested definition for ecological receptor habitat, "any area where an organism/ecological entity exists and is exposed to a contaminant or stressor."

    MDNR Response to EPA Comments of April 24: We will include the suggested definition for ecological receptor in Appendix L. "Habitat" will be defined as "a place where an ecological receptor such as an animal or plant normally lives," and this definition will be placed in Appendix L.

12. As part of the Level 2 Ecological Risk Assessment, site-specific COC concentrations are compared to risk-based eco-toxicity benchmarks. The list of sources for toxicity benchmarks that is provided in the Technical Guidance is incomplete and out-dated compared to those utilized by EPA. Additionally, EPA has substantial concern that the benchmarks will be misapplied if the comparisons are done by individuals that are unfamiliar with how the toxicity benchmarks were derived, such as is the case in Table 5-1 which lists human health protection/fish consumption surface water values as ecological screening benchmarks. The Technical Guidance is also unclear as to which benchmarks from various sources should be used. For example, there are acute and

chronic water quality criteria, many of which are dependent on the hardness or pH of the water. There are effects-range-low (ERL) and effects-range-medium (ERM) sediment quality criteria. ***The EPA strongly recommends that the MRBCA be modified to require that comparisons of COC concentrations to ecological benchmarks be done by trained biologists who are familiar with the ecological risk assessment process as well as with how various toxicity benchmarks are derived.***

MDNR Response to EPA Comments of April 24: **First, we would like to clarify that:**

- **Table 5-1 provides Water Quality Criteria that are lower for ecological species than the MRBCA Default Target Levels (DTLs) for human health protection, and therefore must be checked at the DTL evaluation.**
- **Level 1 refers to a screening level evaluation, which uses Checklists A and B, to determine whether any ecological receptors may be present and of concern.**
- **Level 2 ecological evaluation is performed if Level 1 evaluation indicates the presence of ecological receptors who may be exposed to site-specific chemicals. It involves the comparison of site concentrations with published relevant concentrations protective of ecological receptors**
- **Level 3 ecological evaluation may be required when the Level 2 evaluation indicates the potential for adverse ecological impacts as evidenced by an exceedance of published concentrations or a lack of appropriate published concentrations. The remediating party must develop a work plan to conduct an ecological risk assessment for approval by the department prior to its implementation.**

In Section 6.11.2, we will remove the phrase at the end of the second sentence, "of aquatic ecological species," because the criteria presented are protective of all potential designated uses for surface and groundwater bodies. These values are the lowest of the potential risk-based numbers and regulatory criteria.

We will add the sentence, "A trained professional may be necessary to make these comparisons." Further, the department will review and approve the ecological evaluations, which provides another level of assurance.

EPA Reply of June 23, 2005: As discussed in the 6/17 follow-up conference call to discuss ecological risk issues the response adequately addresses our concern given inclusion of the Ecological Screening Criteria EPA agreed to provide for use in amending Table 5-1. We are in the process of pulling together this information in the same format as used in the MRBCA document (including only those where ecological criteria are more protective than human criteria).

In doing so, EPA identified another possible issue. It appears that situations may arise where no human health pathways would be complete, but for which ecological pathways are complete. Since the ecological risk is only screened against those contaminants

where ecological values are more restrictive than human health target levels, what would happen with a site where COCs were not covered in the ecological screening evaluation?

MDNR Response to June 23, 2005 Reply: We will add the following reference provided to us by USEPA staff:

> ***U.S. EPA, 2003. Ecological Screening Levels. Region 5 RCRA Corrective Action Branch.***

In addition, via a telephone call with the USEPA, the USEPA agreed that existing language in the guidance, such as that on page 9-12 of the February draft, addresses the additional issue raised in June 23, 2005 communication.

General Comments

13. Appendix B of the MRBCA guidance contains values for roughly 350 contaminants. The EPA recommends consideration of expanding this list to include contaminants not identified in Appendix B, but for which values exist in EPA's Region 9 Preliminary Remediation Goal (PRG) tables.

MDNR Response to EPA Comments of April 24: The department will always be able to consider the addition of chemicals to Appendix B. However, an earlier review by the department project managers indicates that this list covers the potential chemicals that would be found on Missouri's sites and for which adequate information is available to develop target values. It is not cost-effective to add chemicals unlikely to be found at Missouri sites. The absence of a chemical on this list in no way implies that it can not be a COC. Furthermore, any tools developed by the department to implement the guidance will allow for flexibility to add additional chemicals.

EPA Reply of June 23, 2005: As discussed in the conference call the response adequately addresses our concern. However EPA believes that adding as many chemicals as possible to the guidance will in turn be more cost-effective for both the department and the regulated community. Anytime a situation arises where a constituent of concern is identified at a site and no corresponding target level has been identified, the Tier 1 screening will not be able to be used as intended, since additional effort will be required to calculate a risk-based value (on the part of the regulated community) and evaluation of that value (on the part of the department). This effort will surely lead to increased time and costs.

MDNR acknowledges the June 23, 2005 comment.

14. The MRBCA guidance appears not to require the evaluation of contaminants for which MCLs exist (see for example, Sections E.2 and E.8). Unfortunately, MCLs are not always risk-based values due to the requirements of the Safe Drinking Water Act. Accordingly, EPA, Region 7 recommends that contaminants with MCLs still be evaluated in the risk assessment in the same manner as contaminants without MCLs.

MDNR Response to EPA Comments of April 24: The MRBCA process does not eliminate chemicals with MCLs from evaluation in the risk assessment process and it allows for groundwater use to be included in a site-wide risk evaluation. If the USEPA would identify the specific language that they believe leads to this assumption, the department will clarify that language.

EPA Reply of June 23, 2005: EPA's would like to provide further clarification because our initial comment was worded ambiguously. Our concern resides primarily with the risk level associated with MCLs. As indicated in Section E.2., if an MCL exists, that value is used as the target concentration at the point of exposure. All contaminants without corresponding MCLs are calculated at $1x10^{-5}$ assuming ingestion of ground water, dermal contact, and indoor inhalation of vapors due to water use. MCLs however are not set at $1x10^{-5}$, rather they vary since the Safe Drinking Water Act provides for other considerations (cost, practicality of treatment technology, etc.). For example Arsenic's MCL which has been set at 10 ppb, does not equate to a $1x10^{-5}$ risk. In the rule EPA estimated a risk range from $6x10^{-5}$ to $3x10^{-4}$ associated with exposure to 10 ppb. This could be a very important oversight especially given the guidance's "Rule of 10" for ensuring site wide risk does not exceed $1x10^{-4}$. As an example, if Arsenic is a COC in groundwater at levels comparable to the MCL, then the site-wide risk will surely exceed $1x10^{-4}$ if any other constituents or pathways are present.

EPA recommends that for screening purposes (such as those values portrayed in Tier 1), MCLs should be replaced with actual risk-based values that translate to the chosen risk level (our preference continues to be at $1x10^{-6}$ for screening purposes, such as the Tier 1 values in MRBCA).

MDNR Response to June 23, 2005 Reply: The department believes that MCLs, as promulgated in the state Water Quality Standards and approved by the USEPA, are appropriate as screening levels for the drinking water pathway. The MRBCA process requires that other pathways associated with impacted groundwater be considered, such as dermal contact and indoor inhalation. In a few cases, the latter pathways may be the risk drivers.

15. Appendix E of the MRBCA guidance frequently uses terms (RAF_o, PC, RAF_d, M, VF_p, etc.) which are not used by EPA or found in EPA guidance and which appear to come from sources such as ASTM E1739-95, making assessment of the equations for

consistency with EPA guidance very difficult. Since most risk assessors conducting risk assessment activities at corrective action sites are familiar with EPA's RAGS guidance this may prove confusing. Given the time frame established for review of the MRBCA guidance, EPA did not have the opportunity to review the supporting references and would recommend at minimum a cross-walk of terms and equations between the two documents.

MDNR Response to EPA Comments of April 24: We do not know to which particular sections or parts of USEPA guidance you refer. If you would like to give us a complete list of these terms and where exactly they are used in the USEPA documents, we would be glad to consider a page of cross-references of terms.

EPA Reply of June 23, 2005: In lieu of incorporating the checklist at this time, such a list can be developed with input from the stakeholder group, and included as part of the initial update or errata sheet.

16. For the purpose of clarity, Figure 2-2 should state that it is the maximum contaminant concentration that is evaluated for the exceedance of either DTLs or applicable WQS. Also, the figure should indicate that when DTLs or WQS are not exceeded, the party may petition the Department for a Letter of Completion, if that is indeed the case.

    MDNR Response to EPA Comments of April 24: We will add this information to Figure 2-2. We note, however, that a separate petition is not needed for the Letter of Completion. The language in Section 2 has been changed to read, "If the maximum soil and groundwater concentrations do not exceed the DTLs and if the site poses no ecological risk, the remediating party should state such in its cover letter on its Initial Characterization Report that it provides to the department, and can request at that time to receive a Letter of Completion."

17. The text in Section 6.12 states that an adequate number of soil samples from each zone must be collected to meet the soil characterization objectives, stating that surface and subsurface soil "may include fill material – the distinction between surface and subsurface soil is one of depth rather than composition." The EPA recommends that additional language be added to clarify that values obtained from sampling of clean fill as a result of corrective actions activities, would not be included as part of the risk assessment since these biased results would accordingly underestimate the degree of contamination present at the site.

    MDNR Response to EPA Comments of April 24: In certain situations, samples collected from clean fill may not be representative of site conditions. For this reason, the MRBCA guidance includes an entire appendix on the estimation of representative concentration (Appendix C). In addition, the objective of MRBCA is to estimate current and future risk. Therefore, for purposes of determining soil target levels, the guidance focuses on areas of current known impact.

EPA Reply of June 23, 2005: Given the department's response, EPA's concerns with respect to this comment can be addressed by making the following changes:

- Modify the first sentence by adding the words, "vertical and horizontal," before the word extent.

- Remove the 3rd sentence in the 3rd paragraph of Section 6.12 since it adds little in the way of information to the Section. For it to be useful additional qualification would be necessary.

- Add the following paragraph after the 3rd paragraph of Section 6.12:

  > As previously indicated in Section 6.4.2, it is extremely important that careful attention be paid to the data collection work plan to ensure that the nature and extent of contamination is accurately characterized. For additional information… (Insert citation as discussed below)

As indicated previously, our preference would be that the additional information reference EPA's Risk Assessment Guidance for Superfund, however if the State prefers another source to assist the regulated universe, please cite that reference.

MDNR Reply to June 23, 2005 Reply: To provide further clarification, we can insert the following in Section 6:

Section 6.1: Add as the last paragraph: "It is extremely important that careful attention be paid to the data collection workplan preparation and implementation to ensure that the nature and extent of contamination is accurately characterized."

Section 6.12: The first sentence will be modified by adding the words, "vertical and horizontal," before the word extent.

Add the following paragraph: "Data collected in areas that are clean (either because the samples were collected beyond the extent of impact or the remedial activities eliminated the COCs) may not be appropriate to use for the calculation of representative concentrations. Use of such data may incorrectly underestimate the representative concentrations. Because of the significance of accurately estimating the representative concentrations for each exposure domain in the overall risk management decision, this concept is further discussed in Appendix C."

We will add the following paragraph after the third paragraph: "As previously indicated in Section 6.4.2, it is extremely important that careful attention be paid to the data collection work plan to ensure that the nature and extent of contamination is accurately characterized."

18. The text in Section 6.15 states that sediment samples must be collected if data shows that contaminated groundwater is discharging to surface water. The EPA also recommends that if surface drainage pathways are suspected of having been impacted by any site contaminants, sediment (and surface water, if present) from those pathways should be sampled.

    MDNR Response to EPA Comments of April 24: We will add, as the second sentence in this section, "If surface drainage pathways are suspected of having been impacted by any site contaminants, sediment (and surface water, if present) from those pathways should also be sampled."

19. Section 8.6 discusses the use of analytical detection limits, and appears to limit that discussion to the use of EPA Method SW-846. The EPA recommends revising this section to include reference to other methods for contaminants of potential concern not included in the SW-846 suite of analytes.

    MDNR Response to EPA Comments of April 24: It was never the department's intent to limit chemical analysis to SW-846 methods. Instead, recognizing that SW-846 methods were widely used by commercial laboratories, our intent was to provide information that these methods have limitations in that not all COCs can be analyzed by those methods and that detection limits of some of those methods are well above the DTLs. To clarify, we will change the wording as below:

    "Because SW-846 Methods are widely used, we have identified the following in Appendix B:

    - ***COCs with DTLs or Tier 1 RBTLs lower than the detection limit or Practical Quantitation Limit (PQL) of SW-846 methods, and***
    - ***COCs that do not have a standard method listed in SW-846.***

    Analysis and detection of COCs are not limited to SW-846 methods. Any Performance Based Analytical method that meets National Environmental Laboratory Accreditation Conference (NELAC) standards may be used for the analysis of COCs in the MRBCA process as approved in the data collection workplan."

20. The text of Section 8.7 refers several times to a "list of representative concentrations" contained in Tables 8-1(a) and (b); however no list appears to be contained in those tables.

    MDNR Response to EPA Comments of April 24: The referenced Table 8-1(a) and 8-1(b) as well as Table 8-2 and 8-3 are a sample part of a worksheet that would be developed by the person performing the risk assessments to account for the additivity of risk. These worksheets and the text in Section 8.7 demonstrates the process that can be used to modify the generic Tier 1 target levels (that are based on a target risk of 1×10^{-5} and a HQ of 1.0) to site-specific Tier 1 target levels that account for additivity and cumulative risk. Thus the intent is that the risk assessors will complete these worksheets using site-specific values.

EPA Reply of June 23, 2005: To address EPA's concern with respect to our comment regarding Tables 8-1(a) and (b), a minor edit can be made to add clarity. Strike the sentence that reads "Tables 8-1(a) and 8-1(b) lists the representative concentrations…" in the first paragraph after the equations portraying total chemical risk and cumulative site-wide risk. The remaining references to Tables are all self-evident.

MDNR Response to EPA Reply of June 23, 2005: The department will remove the last sentence from the first full paragraph on Page 8-8: "Tables 8-1(a) and 8-1(b) lists the representative concentrations…."

21. The text of Section 11.2 requires that risk management plans include a mechanism for periodic examination and re-evaluation of new technologies. However, "periodic" is not defined. The EPA recommends that for consistency with the Superfund program an evaluation every five years may be appropriate. Additionally, the guidance may consider a different name for RMPs since this exact name already carries a connotation for many facilities as part of Clean Air Act requirements in case of chemical releases.

    MDNR Response to EPA Comments of April 24: We intend to meet any statutory requirements with respect to periodic examination and re-evaluation.
    EPA Reply of June 23, 2005: EPA believes the existing language and rationale provided in the response is sufficient for clean-up programs other than Superfund.

    MDNR Response to June 23, 2005 Reply: Under Section 11.2, #9, the department can add the following wording to indicate statutory requirements for CERCLA sites: "For example, CERCLA sites require such a review every five years. Any specific reviews should be noted in the Risk Management Plan."

22. Item number 3 on page C-3 of Section C.1 discusses the need to "determine if the maximum concentration of any COC exceeds ten times the representative concentration of that COC for any exposure pathway." No further information appears regarding the next step if the COC exceeds ten times the representative concentration of that COC for any exposure pathway. If the guidance is to retain this, additional information should be provided (including the inappropriateness of applying this check with a limited data set).

    MDNR Response to EPA Comments of April 24: The intent of this factor of 10 is to provide a check or a red flag that the estimate of average/representative concentration is correct.

    Page 9-11 states: "The maximum concentration of any COC is less than ten times the representative concentration of that COC for any exposure pathway. Note the maximum concentration here refers to the maximum concentration of a chemical in the exposure domain, not the site-wide maximum concentration. This condition can be met if an exceedance can be justified by any of the following and/or appropriate actions taken:
    - ***The maximum concentration is an outlier,***

- ***The average concentration was inaccurately calculated,***
- ***The site is not adequately characterized,***
- ***A hot spot may not have been adequately characterized, or***
- ***Other explanation satisfactory to the department.***

Any exceedance of this condition must be documented and the possible rationale, if any, submitted to the department. The department will determine what actions, if any, will be necessary to address the situation."

We will add the following sentence to the last paragraph above, "For example, if a site is not adequately characterized, then further sampling and analysis may be needed." We trust that the USEPA concern is addressed in this paragraph.

EPA Reply of June 23, 2005: Given the department's response, and notwithstanding our concerns with using the arithmetic average as the exposure point concentration, EPA's concerns with respect to this comment can be addressed by making the following two changes:

- In the third item discussing avoidance of diluting representative concentration, add the following:

  Any exceedance of this condition must be documented and the possible rationale provided to the Department.

  (Alternatively language could be included that references the next steps outlined in Section 9-11).

- In the sixth bullet of Section C.3, Remove the last sentence and add either the same aforementioned language regarding exceedances, or a reference back to the original discussion in Section 9-11.

MDNR Response to June 23, 2005 Reply: In addition, in C.1, the department will rewrite the following paragraph that begins, "When using the average concentration as the representative concentration, the value should not be artificially lowered or "diluted." To avoid this, the following should be kept in mind (Also refer to Section 9.5, "Recommend the Next Course of Action."

23. Section E.1 of the MRBCA guidance considers surface soil to be represented by a depth of 0 – 3 feet. The EPA recommends that the MRBCA guidance follow existing EPA guidance which indicates "Assessment of surface exposures will be more certain if samples are collected from the shallowest depth that can be practically obtained…" (EPA, 1989). The EPA disagrees that a three-foot sample is representative of shallow surface conditions, especially for metals and other constituents that are less mobile.

MDNR Response to EPA Comments of April 24: MRBCA requires that (i) an exposure model that identifies all the complete routes of exposure be developed, (ii) the exposure domain for each route of exposure be identified, and (iii) each exposure domain be adequately characterized by collecting the necessary data. If the nature of the contaminant and/or its release is such that the concentration is more likely to be higher closer to the surface, then this would be reflected in any data collection work plan and in the sampling plan.

EPA Reply of June 23, 2005: The better place to address EPA's concern as discussed is in Section 6 rather than Appendix E. To address EPA's concerns with respect to the discrepancy between EPA guidance and MRBCA, please insert the following:

- After the 2nd paragraph in Section 6.4.2 (which starts, "A release may occur…) please add the following paragraph:

  Please see Section 6.12 to ination, it is extremely important that careful attention be paid to the data collection work plan to ensure that the nature and extent of contamination is accurately characterized. For instance during collection of surface soil samples where metals are a potential concern, it is important to collect data from the shallowest depth that can be practicably obtained, rather than choosing a random sampling interval in the 0-3 foot zone, or compositing samples across the entire zone. Simply using data from a 0-3 foot interval can dilute the concentration if contamination is not homogenous across the soil profile. For additional information… (Insert citation as discussed below)

  Our preference would be that the additional information reference be EPA's Risk Assessment Guidance for Superfund, Soil Screening Guidance, and Supplemental Screening Guidance, however if the State prefers another source to assist the regulated universe, please cite that reference.

MDNR Response to June 23, 2005 Reply: To provide additional information on this issue, the department can add the following to Section 6.4.2 after the second paragraph: "During collection of surface soil samples where metals are a potential concern, it is important to collect data from the shallowest depth that can be practicably obtained, rather than choosing a random sampling interval in the 0-3 foot zone, or compositing samples across the entire zone. Simply using data from a 0-3 foot interval can dilute the concentration if contamination is not homogenous across the soil profile. These types of concerns should be addressed in the data collection work plan."

24. Step 3 in Section E.8 in the establishment of target levels for groundwater protection identifies the use of point of detection (POD) wells. The text states that "POD wells are located between the source and the POE [point of exposure] to monitor the COC concentrations in groundwater as a means of protecting against exceedances at the POE.

Risk-based target concentrations will be developed for the POD using appropriate fate and transport models and site-specific parameters as explained in Section E-12." However, no Section E-12 appears to exist.

MDNR Response to EPA Comments of April 24: Section E-12 is included in the MRBCA guidance document and consists of the equations used to calculate target levels. The calculation of allowable concentrations at the point of demonstration (POD) is on page E-54. We will move the "References" information on Page E-12 to the end of this appendix in order to clarify this section.

25. The text in Section E.8 makes use of several dilution attenuation factor (DAF) values. Since these values are not consistent with EPA risk assessment guidance, the MRBCA document should explain the source of these values. This same comment applies to the default exposure factors in Table E-3 and the values presented in Table E-4.

MDNR Response to EPA Comments of April 24: To evaluate the migration of COCs in soil and groundwater, the MRBCA process requires three DAFs. These are (i) DAF due to migration of leachate from the source to the groundwater, (ii) DAF in the mixing zone directly below the source and (iii) DAF due to horizontal migration in the groundwater. These DAFs are estimated as follows:

> ***Unsaturated zone DAF: Default value is 1, which assumes no attenuation. The DAF are based on the assumption that, as the depth to groundwater increases, attenuation of chemicals will be greater due to travel distance. MRBCA provides the option to develop a site-specific DAF using unsaturated zone fate and transport models.***
>
> ***Saturated Zone DAF: This is calculated using Domenico's model, which is a publicly available model initially published in a peer reviewed journal <u>entitled Groundwater</u>.***
>
> ***Mixing Zone DAF: This DAF is calculated using the Summer's model. This is the same model used to estimate DAF factor in EPA's Soil Screening guidance document and also incorporated in the USEPA Composite Model for Landfill.***

EPA Reply of July 13, 2005: The use of the Domenico Equation for determining saturated zone dilution attenuation factors is appropriate only when the "Revised Domenico Model" is used. However, the model's accuracy is questionable when vertical distribution of contamination has not been adequately evaluated. If this is to be retained for determining saturated zone dilution attenuation, MDNR should place increased emphasis on the importance of accurately characterizing vertical distribution and recommend multi-port sampling or nested wells.

MDNR Response to July 13, 2005 Reply: Based on our conference call with EPA personnel on Monday, July 25, 2005, EPA agreed that this comment was valid only when a biodegradation rate is used for estimating the dilution attenuation factor using

the Domenico's model. Since Tier 1 assumes no biodegradation rate, this comment is not valid for Tier 1.

For subsequent tiers that may use a non-zero biodegradation rate, MDNR will add the following insert as Section 9.1.2:

> ***Section 9.1.2: Biodecay Rate (λ)***
>
> ***This parameter is an input to the Domenico's model that is used to estimate the migration of chemicals in the saturated zone. Specifically, it is used in the backward mode of risk assessment to estimate the dilution attenuation factor. In the forward mode, the parameter may be used to calculate downgradient concentration based on a known source.***
>
> ***In a Tier 1 risk assessment, the biodecay rate is assumed to be zero. In a Tier 2 and Tier 3 risk assessment, a site-specific non-zero biodecay rate may be used. Prior to using the biodecay rate, the remediating party must provide evidence for department approval that supports the use of any specific value used. The remediating party is encouraged to consult the open literature to identify technical approaches to estimate site-specific biodecay rates. The site-specific estimation of biodecay rate may require an understanding of the site-specific three-dimensional distribution of the plume based on multilevel sampling. For additional details, also refer to Robbins (2002).***

We will also add the following reference to Section 13:

> ***Robbins, G.A., 2002. Accounting for Vertical Concentration Averaging in Monitoring Wells When Using the Domenico Equation and Implications for Determining Biodegradation Rates in Inverse Modeling presented in 20002 Denver Annual Meeting on October 27 – 30, 2002. Geological Society of America.***

TECHNICAL COMMENTS

26. In the past, the EPA and its contractors have supported MDNR in risk assessment review. The EPA will be unable to provide this level of support for risk assessments which utilize the MRBCA approach. The MRBCA process is sufficiently dissimilar from EPA's approach that it would require significant training of our risk assessors just to become familiar with the process. The EPA's concern is that with our limited risk assessment resources, we must focus our effort on maintaining staff's proficiency in changes, updates, and new information pertaining to the Superfund RAGS process.

MDNR Response to EPA Comments of April 24: There is no requirement that the USEPA learn this process.

27. The text in Section 6.5.3 requires a well survey to be conducted which locates all public water supply wells within a one-mile radius of the site, and all private water wells within a quarter-mile radius of the site. The EPA recommends that the radius of the private well survey be determined on a site-specific basis because some sites with groundwater contaminant plumes of greater aerial extent may warrant a survey with a larger radius.

Response to EPA Comments of April 24: This same section contains the following language, "These distances may vary among federal authorities and will also be dependent on COC mobility and hydrogeology." We trust that this language addresses the USEPA concern.

EPA Reply of June 23, 2005*:* A minor change to Section 6.5.3 will address the Agency's concern. Modify the sentence in parantheses in the first paragraph of Section 6.5.3 to read as follows:

> The radially distances referenced above are minimum requirements. Well surveys of greater aerial extent may be necessitated by relevant federal requirements or differences in COC mobility and/or hydrogeology at the specific site.As discussed in the 6/15 conference call the response adequately addresses our concern.

MDNR Response to June 23, 2005 Reply: In Section 6.5.3, we will modify the parenthetical sentence in the first paragraph to read:

> ***"The radially distances referenced above are minimum requirements. Well surveys of greater aerial extent may be necessitated by relevant federal requirements or differences in COC mobility and/or hydrogeology at the specific site."***

28. Section 6.6, Analysis of Current and Future Groundwater Use: This section proposes to base characterization and clean-up decisions on an aquifer's demonstrated or potential usability. To streamline the process of making groundwater use determinations and to prevent ad hoc decisions and differing determinations between project managers, the state should consider establishing a state governmental workgroup to classify groundwater resources within the state. The EPA's guidance entitled *Final Comprehensive State Ground Water Protection Program Guidance* provides general recommendations for classifying groundwater resources. This document can be accessed at the following link: http://www.epa.gov/superfund/resources/remedy/pdf/100r-93001-s.pdf

MDNR Response to EPA Comments of April 24: We appreciate the recommendation to look at EPA guidance concerning classification of groundwater resources. While the department has no immediate plans to pursue groundwater classification, this guidance would prove beneficial to that effort.

EPA Reply of June 23, 2005: It is EPA's belief that this guidance has potential for conflicting use determinations for the same aquifer, due not to the criteria for making classification decisions, but for the ad hoc process in which they are likely to be made. MDNR must keep in mind that EPA is the primary regulatory authority on many Superfund sites and a conflicting aquifer use determination between neighboring EPA and state-lead sites would likely result in significant problems for MDNR, EPA, the regulated entities, and the public. To avoid this potential problem, EPA strongly encourages MDNR to undertake some systematic means of classifying its groundwater resources.

MDNR acknowledges the EPA reply.

29. Section 6.7 discusses soil characteristics of the vadose zone but does not account for secondary permeability. Please include the characteristic soil secondary permeability percent.

MDNR Response to EPA Comments of April 24: We will include the following statement in Section 6.7: "Consideration should be given to preferential pathways. For example, desiccation cracks may provide a preferential pathway at sites where the primary soil type is clay."

30. Section 6.7.1, Thickness of Vadose Zone and Depth to Groundwater, briefly mentions that depth to groundwater is used to determine vadose zone attenuation factors. It should also be noted here and elsewhere in this document where such factors are actually calculated that the validity of such calculations is dependent upon the existence of certain simplifying assumptions about the geology. First and foremost is the assumption that the vadose zone media in question is relatively homogenous and isotropic with respect to permeability. These common attenuation modeling assumptions are violated for most clays, however, due to the presence of significant fracturing (secondary porosity). The presence of significant fractures potentially provides a direct conduit for vapors to move with little attenuation between the water table and an overlying building. For this very reason, EPA's *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings* does not include clays within its table on soil types which may be used with the Johnson-Ettinger model (Table 11). This section of the MRBCA guidance should note that granular media-based attenuation factors should not be calculated for fractured media, including clay units, where direct pathways potentially exist between the water-table and overlying buildings.

MDNR Response to EPA Comments of April 24: We agree with EPA's comment that attenuation factors depend on the media and the specific characteristics of the media and believe that this concept is implicit in the language. However, the department will add the following language to clarify this further: "At sites where significant

secondary porosity features are identified, the calculation of the DAF should not be based on the assumption of granular media. Alternative methods to estimate the DAF and any alternative data needs must be proposed to the department."

EPA Reply of June 23, 2005: The proposed response to deal with sites exhibiting significant secondary porosity by calculating a DAF will not be sufficient in and of itself. Accordingly the second sentence of the proposed language should be modified to read as follows:

> Alternative methods to estimate the DAF and any alternative data needs must be proposed to the department, but where significant fracture porosity is identified, direct methods for measuring air impacts should be used where a valid DAF cannot be established.

MDNR Response to June 23, 2005 Reply: In addition to the sentence proposed in our first response, we will add to this, "For sites where DAF cannot be accurately evaluated, the remediation party may propose alternative methods to evaluate the indoor inhalation pathway for department approval."

31. Section 6.15, Distribution of Chemicals of Concern in Sediment and Surface Water Bodies: This section proposes to evaluate groundwater contaminant plume impacts on surface water bodies by collecting and analyzing surface water and sediment samples. However, this proposed approach may not be adequately protective of ecologic receptors within the receiving water body. Many organisms spend at least part of their time beneath the sediment-water interface in the hyporheic zone where they can be exposed to contaminant concentrations that are much higher than would be detectable within surface water alone. Sediment analyses that fail to include analysis of sediment pore water would also likely inadequately characterize impacts in this zone. Furthermore, great care must be taken in clearly locating actual discharge zones, since the location of such zones may not be intuitively obvious. If a surface water body is identified as a potential discharge point, a more detailed site-specific assessment of ecologic impacts should be required beyond simple surface water and sediment sampling. The EPA is in the process of developing a EcoUpdate/Issue Paper entitled *Evaluating Ground-Water / Surface-Water Transition Zones in Ecological Risk Assessments* which should be referenced as a general guide for completing such evaluations. This impending guidance is currently undergoing external peer review.

MDNR Response to EPA Comments of April 24: In addition to the sentence added in Comment #18, we will also add the following sentence to 6.15, "Sediment analyses should include an analysis of sediment pore water to adequately characterize impacts in hyporheic zone." We will add a definition of hyporheic zone to Appendix L: "Region beneath and adjacent to streams and rivers where surface and groundwater mix."

We appreciate the reference to the draft ECO/Update Issue Paper. Please keep us apprised of its status for incorporation as a reference in future updates of this document.

EPA Reply of June 23, 2005: If reference to EPA's *Evaluating Ground-Water / Surface-Water Transition Zones in Ecological Risk Assessments* EcoUpdate/Issue Paper, can be included as part of the initial update or errata sheet, the response adequately addresses our concern.

References Referred to in MDNR Response:

California Center for Land Recycling, October 1998. Strategies for Promoting Brownfield Reuse in California.

MDNR, February 2005. Missouri Departmental Risk-Based Corrective Action (MRBCA) Technical Guidance.

Robbins, G.A., 2002. Accounting for Vertical Concentration Averaging in Monitoring Wells When Using the Domenico Equation and Implications for Determining Biodegradation Rates in Inverse Modeling presented in 20002 Denver Annual Meeting on October 27 – 30, 2002. Geological Society of America

US EPA, 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A. Interim Final. December 1989. EPA/540/1-89/002.

US EPA, March 25, 1991. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors" Interim Final. OSWER Directive 9285.6-03.

US EPA, 1996. Soil Screening Guidance: User's Guide. July 1996.

US EPA, 1997. Exposure Factors Handbook Volume 1 – General Factors. August 1997. EPA/600/P-95/002Fa.

US EPA, 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November 29, 2002.

US EPA, 2003. Ecological Screening Levels. Region 5 RCRA Corrective Action Branch.

US EPA, 2003. Human Health Toxicity Values in Superfund Risk Assessments. December 5, 2003. OSWER 9285.7-53.

US EPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). July 2004. EPA/540/R/99/005. OSWER 9285.7-02EP.

US EPA Region IX, October 2004. Preliminary Remediation Goal (PRG) tables. http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf.